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MINERALOGICAL EXAMINATION OF SAMPLES FROM MAMIE DEPOSIT OF CONSOLIDATED SILVER STANDARD MINES LTD., VANCOUVER

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Mineralogical Examination of samples from Mamie Deposit of Consolidated Silver Standard Mines Ltd., Vancouver

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ABSTRACT

Samples of ore from the Mamie deposit, near Smithers, B.C. were examined under the START program. Mineralogical investigations of the samples provided show that the major sulphide minerals are pyrrhotite, sphalerite, and chalcopyrite. Lesser amounts of arsenopyrite, marcasite, galena and pyrite are also present.

Electrum (AuAg), argentiferous tetrahedrite and a silver telluride (possibly hessite) were identified. Metallic bismuth, and a bismuth telluride account for the bismuth content of the ore.

Only 5 polished sections were examined and therefore no meaningful process mineralogy can be derived in terms of recovery. However some recovery problems might occur due to electrum locked in quartz, cyanide consumers such as marcasite and bismuth, and refractory silver-bearing minerals such as tetrahedrite, and silver telluride.

Recommended further work, to be carried out for process optimization or if bench test recoveries are poor, include a complete Au and Ag characterization study to determine, by image analysis, the predicted potential recovery of silver and gold. This should be followed by a liberation study of concentrates and tailings, again using X-ray-based automated image analysis.

INTRODUCTION:

Samples of sulphide ores were submitted to the Process Mineralogy Section, CANMET for mineralogical examination under the terms of the START program. The mineralogical examination was aimed at locating gold or gold-bearing minerals and their mineralogical associations. Reflected light microscopy, X-ray diffraction, and scanning electron microprobe analyses were carried out.

SAMPLE: Five polished sections prepared from ore samples from the "Mamie" deposit near Smithers, B.C. were submitted for study on March 25, 1985. The samples had originally been submitted to CANMET by R.A. Quartermain, Pres., Consolidated Silver Standard Mines, Ltd., Vancouver, B.C. The deposit was reported to contain 11 g Au/tonne and 103 g Ag/tonne.

METHOD OF INVESTIGATION: The minerals in the ore samples were identified by the combined methods of ore microscopy, qualitative energy dispersive analyses (EDXA), quantitative electron microprobe analysis (EMPA) and powder X-ray diffraction analysis (XRD).

RESULTS: The results of the study show that the major ore minerals are pyrrhotite, sphalerite and chalcopyrite. Lesser amounts of arsenopyrite and marcasite together with minor amounts of galena and pyrite account for most of the remainder. Also present are minute amounts of electrum (AuAg), rutile, argentiferous tetrahedrite, metallic bismuth, a silver telluride tentatively identified as hessite(?) and a bismuth telluride.

The principal gangue mineral is quartz. Small amounts of mica, feldspar and trace amounts of a carbonate and apatite are also present.

Gold: Gold was found only in the form of electrum, a gold-silver alloy. It occurred as small to minute inclusions in quartz (Figure 1) and in a more complex association with sphalerite and apatite (Figure 2). Only four grains in all were found and ranged from approximately five to sixty micrometres in size. The grains tarnished in air readily after polishing, indicating a high silver content. Electron microprobe analyses of the three largest grains confirmed their high silver content (Table I).

Silver: Two other silver-bearing minerals were found in the ore samples. The first consisted of minute grains of argentiferous tetrahedrite in an intimate intergrowth with galena and metallic bismuth (Figure 3). The second consisted of minute grains of a silver telluride commonly found in galena in conjunction with metallic bismuth (Figure 4). Although a definitive analysis was not obtained, the results indicate a composition very close to Ag_2Te. An assessment of the silver content of the tetrahedrite by electron microprobe analyses gave an average value of 22 wt. % Ag.

Other Minerals: Sphalerite, pyrrhotite, chalcopyrite and arsenopyrite occur essentially as small masses and disseminations in gangue. Marcasite, which is so fine-grained it appears isotropic, occurs as elongate colloform bodies replacing pyrrhotite (Figure 5). The marcasite contains some minute particles of pyrite. Galena is present largely as inclusions in sphalerite and chalcopyrite. The metallic bismuth forms minute inclusions in galena, usually adjoining small particles of the hessite (Ag_2Te). One minute grain of a bismuth telluride was identified in the chalcopyrite.

CONCLUSIONS: Although the type and quantity of sample submitted for study was minimal, several conclusions can be made concerning the potential recovery of the gold and silver, particularly if by direct cyanidation of a bulk sulphide concentrate. Such recoveries would be severely affected by (a) the occurrence of the electrum in quartz, (b) the presence of minerals deleterious to cyanidation such as bismuth and (c) the occurrence of major portions of the reported silver content as tetrahedrite (poorly leachable) and as a telluride (unleachable).

TABLE I

Electron microprobe analysis of the electrum*

	Analysis #1	Analysis #2	Analysis #3
Element	ave. wt. %	ave. wt. %	ave. wt. %
Ag	38.2	47.1	59.5
Au	62.1	52.3	39.7
	100.3	99.4	99.2

*The severe tarnish on these grains was removed just prior to their analysis.

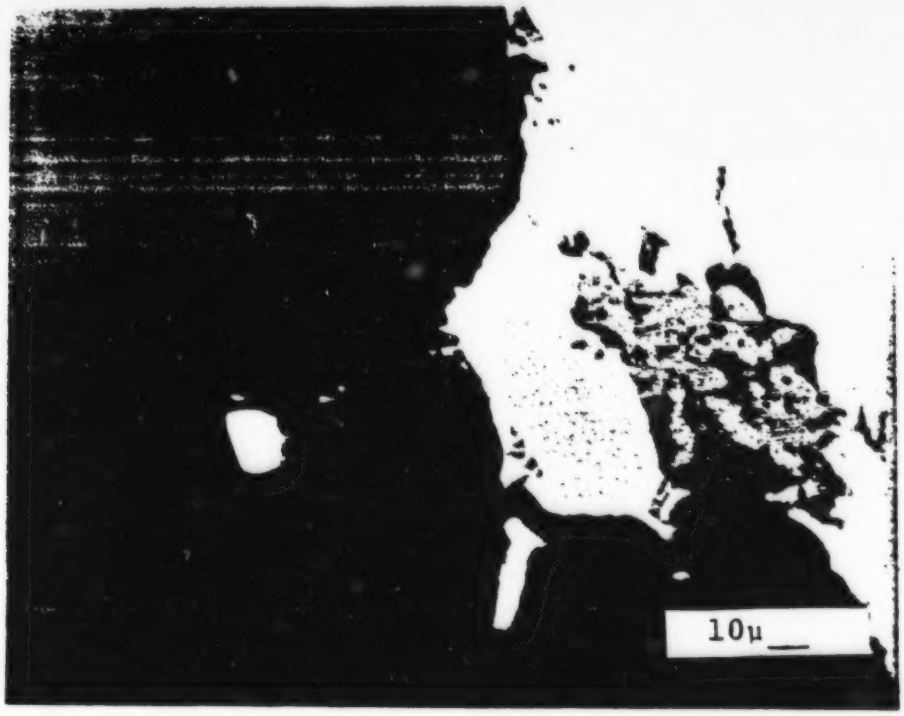

Figure 1. Backscattered electron image showing a grain of electrum (white) in quartz (black) with sphalerite (grey) to the right.

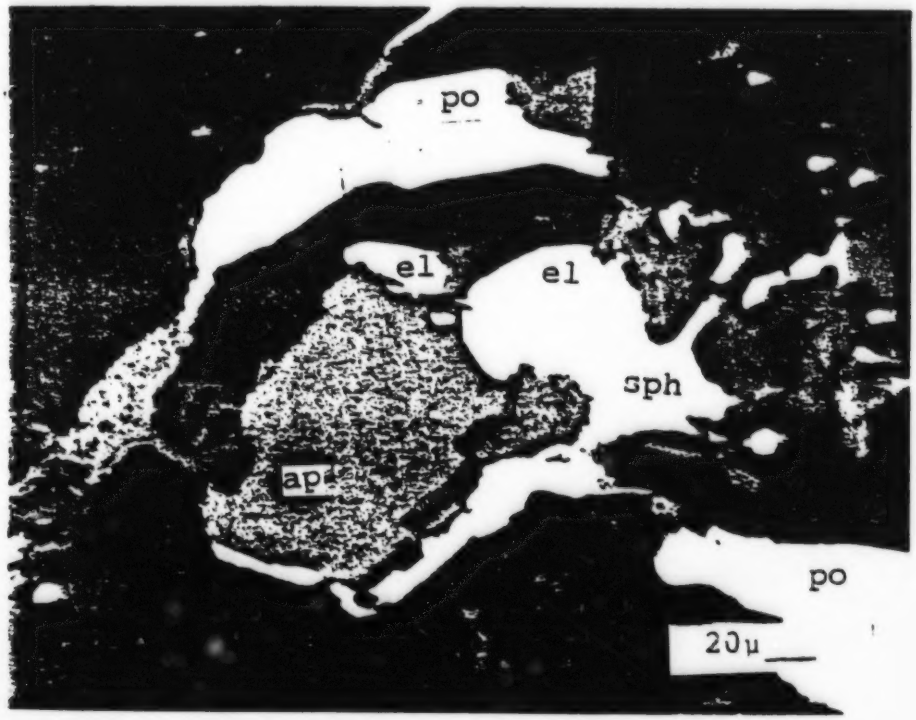

Figure 2. Backscattered electron image showing two grains of electrum (el) associated with sphalerite (sph), and apatite (ap) in quartz (black). Several grains of pyrrhotite (po) are also present.

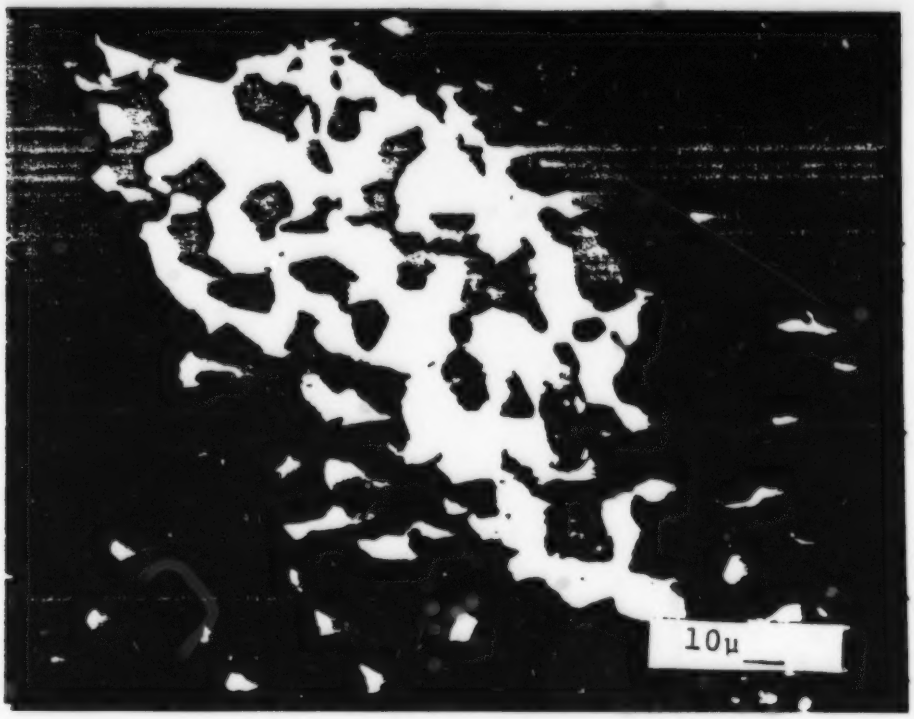

Figure 3. Backscattered electron image showing an intimate intergrowth of bismuth (white), galena (light grey) and argentiferous tetrahedrite (dark grey) in chalcopyrite (black).

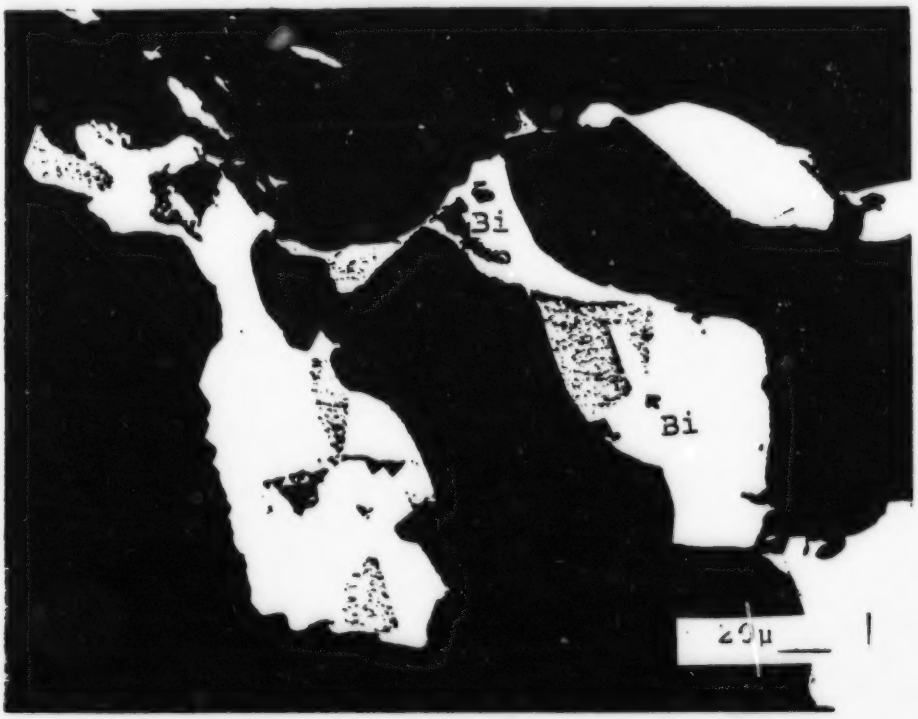

Figure 4. Backscattered electron image showing associated hessite (dark grey), bismuth (Bi) and galena (light grey) in sphalerite (black).

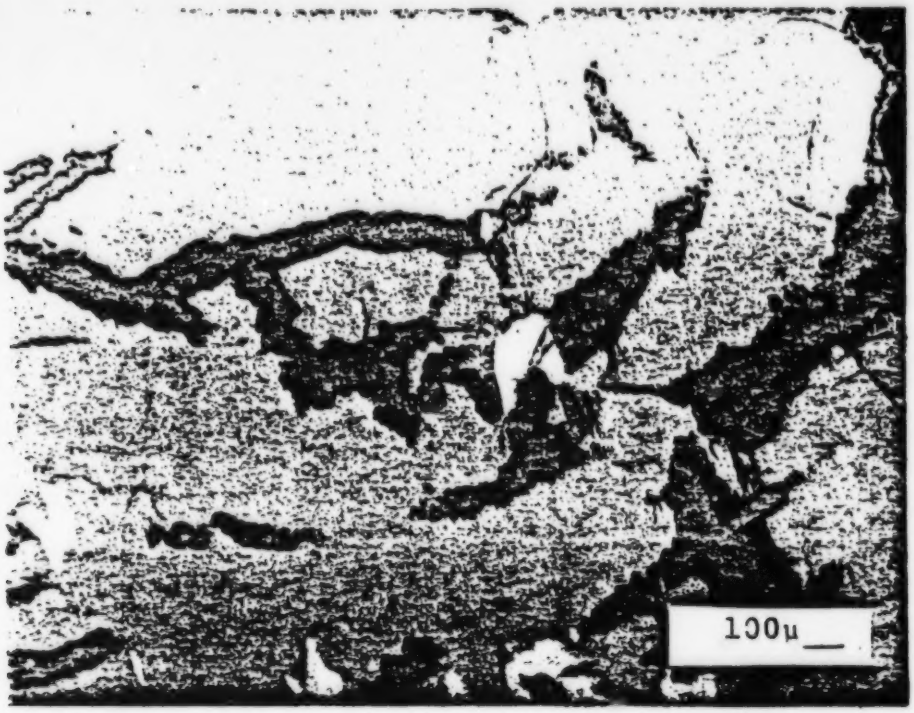

Figure 5. Backscattered electron image showing pyrrhotite (medium grey) partly replaced by colloform marcasite (dark grey). Several grains of sphalerite (light grey) are present in the pyrrhotite.